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AN ASSESSMENT OF THE ECONOMICS OF THE NORTHERN SHRIMP FISHERY

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FORWARD

The core of this paper was written during the summer of 1986 based on the best data available at that time. Generally, the paper does not reflect the results of the 1986 fishery whereby high shrimp prices generated renewed interest in the fishery. The success of the 1986 fishery, combined with the government policy to discontinue royalty charters and issue additional licences, has attracted a number of private sector proposals to government to utilize northern shrimp licences. These proposals have significantly improved the quality of the data on the northern shrimp fishery and to a degree have rendered this paper somewhat dated. Nevertheless, the paper is being released to indicate the state of the art in the summer of 1986.

An early draft of the paper was reviewed by all members of the Program Coordination and Economics Branch, Newfoundland Region. Peter Hood was particularly helpful in providing comments and editorial assistance. Wayne Follett gave valuable assistance in constructing this version of the computer simulation model of a groundfish processing plant, although he should not be held responsible for the end product. Helen Flynn and Marilyn Bugge typed the various drafts with exceptional competence and courtesy. The author retains responsibility for any errors.

1. INTRODUCTION

The two-fold purpose of this paper is to establish a framework for the analysis of the northern shrimp fishery and to outline the existing conditions in that industry. A great deal of progress has been made toward the initial objective of establishing the analytical framework. A computer model has been developed that is capable of assessing the economics of a harvesting and processing operation over a wide range of price, cost, catch and effort assumptions for a number of distinct fisheries over a multi-year horizon. The model analyses the economic viability of harvesting and processing northern shrimp as a complement to harvesting and processing northern cod. Data has been gathered in support of the model and a number of simulations have been performed. The model building, data collection and the simulations have identified the areas where additional work is required.

It was decidedly more difficult to fulfill the second objective of analysing the economic conditions in the industry. There is a very small number of participants in the industry whose operations are sufficiently different that it is not possible to identify a "typical" operation. Since an average vessel does not exist, it is difficult to summarize the economic viability of the fleet without delving into the proprietary activities of the individual companies. This analysis therefore considers the viability of two hypothetical vessels fishing northern shrimp whose activities are based on the best available

information with respect to the activities of the northern shrimp licencees. The vessels are assumed to participate in a seasonal cod fishery and the paper includes an assessment of the economic viability of harvesting and processing cod.

Section 2 presents an historical review of the fishery. Section 3 overviews the performance of the individual licencees. Section 4 assesses the economic viability of harvesting and processing both shrimp and cod. Section 5 relates the study to current issues in the fishery. Appendix A provides background material on catch rates.

2. HISTORICAL REVIEW OF THE NORTHERN SHRIMP FISHERY

During the early 1970's a number of cruises by the Industrial Development Branch of the Federal Department of Fisheries established that shrimp stocks existed off Newfoundland and Labrador. In 1977 the Department of Fisheries and Environment, in conjunction with Fishery Products Ltd., undertook a project to determine the feasibility of a commercial shrimp fishery off Labrador. Between July 7, 1977 and November 28, 1977 the Zermatt and Zaragoza, as well as two Norwegian vessels, fished in excess of 299 days with a catch rate that averaged 8 tonnes/day.

The successful 1977 experiment led to the initiation of a commercial shrimp fishery off coastal Labrador in 1978. By February 1978, approximately 50 applications had been received for licences from fishermen and processors to fish shrimp off Labrador. Approximately 40 percent of the applications were from Newfoundland, 40 percent were from the Maritimes and the majority of the remainder were from Quebec.

When the harvesting licences were issued in 1978 the priorities were:

A. Canadians active in 1977;
B. Individual fishermen if possible;
C. Fish co-operatives (possessing processing capacity);
D. Corporations possessing the capacity to process shrimp.

When the actual licences were issued, a number of licencees had not been previously licenced to operate in the Atlantic fishery.

Figure 1 indicates the fishing grounds that have been traditionally considered in the northern shrimp fishery and Table 1 presents the TAC and landings to 1985 for the individual areas associated with the northern shrimp fishery. Figure 2 provides a graphical view of northern shrimp landings by area. The Hopedale Channel contributed a large share of the early landings in the fishery but since 1982, the landings have fallen below the level in the initial years. The Cartwright Channel was a principal source of supply in 1978 and 1979, but has thereafter been a marginal supplier. In recent years, the shrimp stock in NAFO Subarea 0 (SA0) has been a large contributor to the fishery, and its importance has been accentuated by Canada not being permitted to fish shrimp in Subarea 1 since 1980. The Hawke Channel, NAFO divisions 3K and 2G and the Ungava Bay and Eastern Hudson Strait have not attracted a significant fishing effort.

Table 1 also indicates that landings are well below the TACs in all areas of the northern shrimp fishery, even in the "prime areas" of SA0 and Hopedale Channel.

Significant events in the northern shrimp fishery are noted as follows on an annual basis.

1978

Eleven northern shrimp licences were issued: five to residents of Newfoundland, two to Quebec residents, and four to residents of the Maritimes. Seven of the eleven licencees were active in 1978. Four foreign vessels were chartered and three domestic vessels (two freezer trawlers and one

FIGURE 1

NORTHERN SHRIMP FISHING AREAS

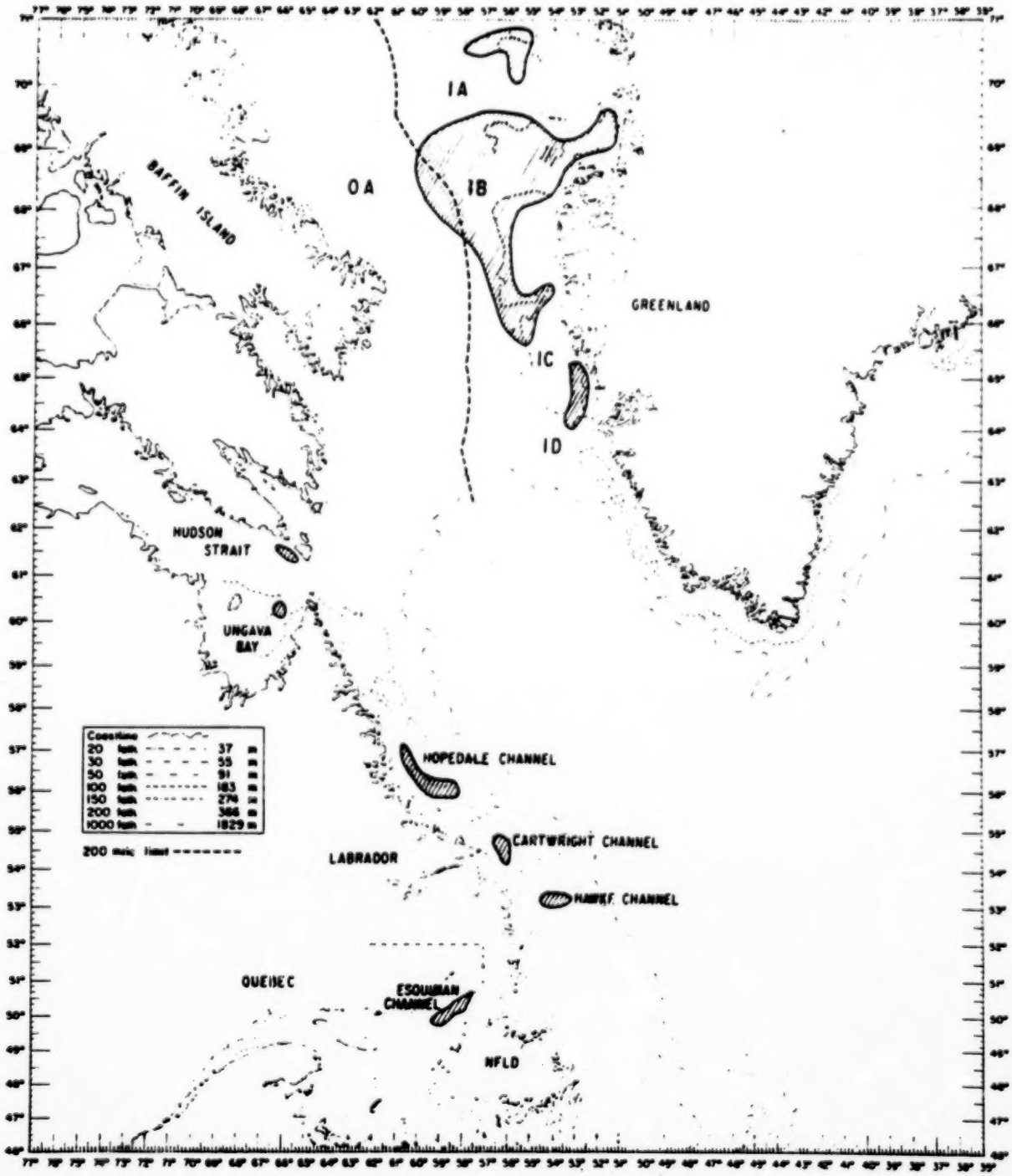


TABLE 1
PROFILE OF NORTHERN SHRIMP LANDINGS (t)

	1978	1979	1980	1981	1982	1983	1984	1985
SubArea 0								
TAC	1000	2000	2500	5000	5000	5000	5000	6120
Landings	-	566	1444	4474	2660	4014	2279	3073
Difference	1000	1434	1056	526	2340	986	2721	3047
SubArea 1								
TAC	NA	NA	NA	NA	NA	NA	NA	NA
Landings	-	276	588	-	-	-	-	-
Difference	-	NA	NA	-	-	-	-	-
Hopedale Channel								
TAC	4500	3200	4000	4000	4000	4000	3500	2800
Landings	2109	2693	3938	3493	1829	997	712	1687
Difference	2391	507	62	507	2171	3003	2788	1113
Cartwright Channel								
TAC	800	800	800	800	800	800	700	770
Landings	1521	1034	170	5	167	3	290	2
Difference	-721	-234	630	795	633	797	410	768
Hawke Channel								
TAC	800	800	800	850	850	850	850	850
Landings	-	-	135	123	-	-	-	-
Difference	800	800	665	727	850	850	850	850
Divisions 3K/2G + UNGAVA								
TAC	1000	1000	1000	1000	1000	1000	1000	1850[1]
Landings	-	-	-	-	1	30	-	-
Difference	1000	1000	1000	1000	999	970	1000	1000
TOTAL TAC	8100	7800	9100	11650	11650	11650	11050	12390
TOTAL LANDINGS	3630	4569	6275	8095	4657	5044	3281	4762
TAC MINUS LANDINGS								
All Areas	4470	3231	2825	3493	6993	6606	7769	7628
SubArea 0 and Hopedale Channel	3391	1665	530	1033	4511	3989	5509	4160

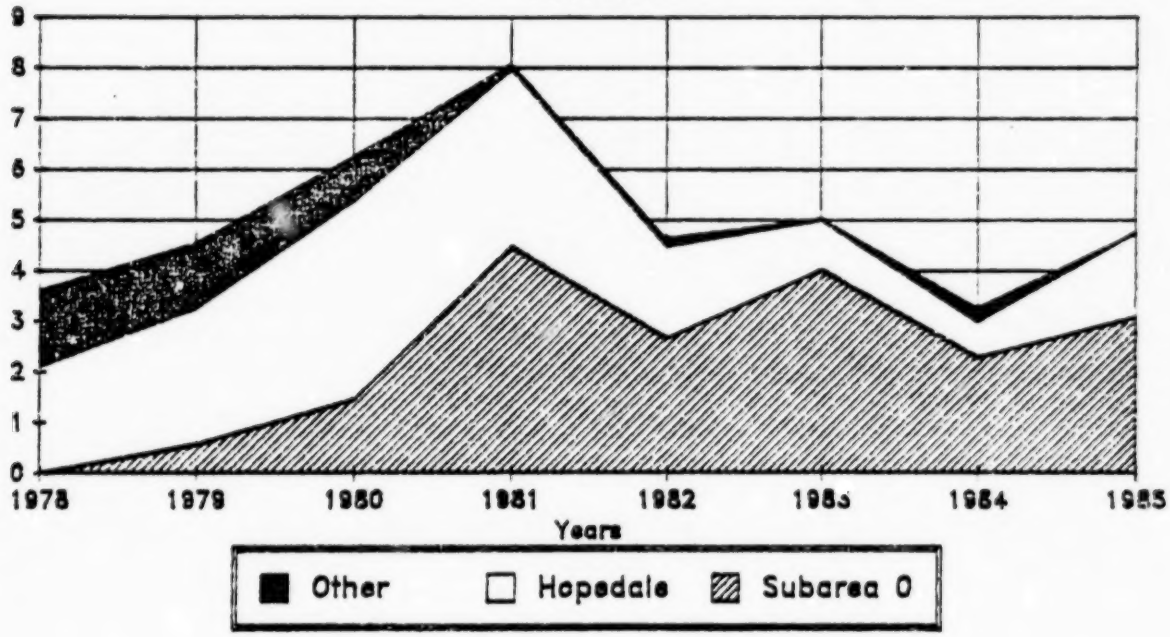
[1]includes 850 tonnes for Eastern Hudson Strait and Ungava Bay

NA - not applicable

wetfish trawler) were used. Total landings equalled 3,630 tonnes, all of which was caught in the Hopedale and Cartwright Channels.

Canada was assigned a 1,000 tonnes allocation in Subareas 0 and 1 combined that was not further sub-divided nor fished in 1978.

Figure 2 – Northern Shrimp Landings (.000 tonnes), 1978–85



1979

All eleven licencees were active in the fishery in 1979. The licencees that operated a chartered vessel in 1978 were advised to have purchased a vessel by September 1979. Others were given until September 1, 1980 to operate a vessel in the fishery.

A one year permit was also issued in July 1979 to Makivik Corporation representing the Inuit of northeastern Quebec. The licencee was restricted to fishing a quota in the Davis Strait and its product was to be labelled **Product of Canada.** Makivik, operating under a subsidiary company, Imaqpik Fisheries Inc. was not permitted to fish on a royalty basis but was expected to have its own vessel by February 1980. The date was later extended to September 1980, by which time they had purchased a vessel.

The licencees were initially required to land and process at least 50 percent of their catch on shore. Chartered vessels were also required to be at least 25 percent crewed by Canadians. Many of the licencees found it difficult to meet the requirement that 50 percent of the catch be processed on shore and this requirement was subsequently waived. The vessel purchase deadline was extended and the Canadianizing of the crew requirements were not met.

The total shrimp catch in 1979 was 4,569 tonnes, a 26 percent increase from the prior year.

1980

In 1980 each licence holder was allocated 436 tonnes for the Cartwright and Hopedale Channels. The Makivik Corporation was granted, in a separate allocation, 436 tonnes in Subareas 0 and 1. The remaining 2,064 tonnes in Subareas 0 and 1 and the TAC's in the Hawke Channel and Divisions 2G and 3K were to be fished on a competitive basis.

In the Davis Strait in 1980, Canada had been allocated 2,500 tonnes, 500 tonnes in Subarea 0 and 2,000 tonnes in Subarea 1. The fishery in Subarea 1 closed in mid-July and the fishery in Subarea 0 was closed at the same time to all vessels except Makivik. Subsequently, it was determined that the 500 tonnes quota in Subarea 0 had not been taken and the fishery was reopened to two charter vessels. On the Labrador coast, the fishery was concentrated in the Hopedale Channel.

In response to the exploratory/experimental success in the Eastern Hudson Strait/Ungava Bay area, the Labrador Fishermen's Union Shrimp Co. Ltd., Lameque Co-operative Ltd. and Quebec United Fishermen requested access to these areas in 1980 to fish a maximum of 50 tonnes each. Imaqpik also fished the Eastern Hudson Strait/Ungava Bay area in 1980 under an experimental survey. The total catch from these areas was 236 tonnes, most of which was taken just west of Resolution Island.

Eastern Quebec Seafoods were not permitted to fish in 1980 because they had chartered vessels the previous two years and had not met the deadline for vessel purchase established by the Department in 1979.

The total landings in 1980 were 6,275 tonnes, which was an increase of 37 percent from 1979.

1981

In 1981 Canada and the EEC were unable to agree on a shrimp fishing plan for Subareas 0 and 1. The Northwest Atlantic Fisheries Organization (NAFO) recommended a total TAC of 29,500 tonnes for the West Greenland shrimp fishery. Canada claimed 17 percent of the TAC for Subarea 0 which amounted to 5,000 t. The EEC decided to fish the entire 29,500 tonnes TAC (plus an additional 500 tonnes) in Subarea 1.

In 1981 vessel quotas for the first time depended on whether the vessel was a domestic or foreign charter operation. Charter operators were given a smaller vessel quota than domestic operators both in Subarea 0 and on the Labrador coast. Domestic vessels were assigned quotas on the Davis Strait and their quota for the Labrador coast was made specific to the Hopedale Channel.

A pooling formula was also introduced in the 1981 fishery whereby two or more vessel owners could pool their quotas such that using a smaller number of vessels, they could effectively

harvest 83 percent of their combined quotas. A 500 tonnes allocation was also set aside for a vessel charter for surveillance and enforcement and all vessel quotas were subject to a phase-out schedule so that uncaught quota would be reallocated.

Total landings in 1981 were 8,095 tonnes, the peak landings in the history of the fishery to date, and 30 percent above the landings of the previous year.

1982

In 1982, individual vessel quotas were not issued for Subarea 0 as the 5,000 tonnes quota was fished on a competitive basis. Canadian vessel owners were assigned 3,000 tonnes and charter operators were assigned 2,000 tonnes. Individual vessel quotas were assigned for the Hopedale Channel, but Cartwright and the Hawke Channel were fished competitively. Foreign charters for the first time were restricted to Subarea 0.

Seven licencees participated in the Davis Strait fishery, three of which utilized foreign vessel charters. Eight licencees participated in the Labrador fishery with two of the licencees pooling their licences to fish in the Hopedale Channel. The total catch in 1982 was 4,657 tonnes, 43 percent below the 1981 landings, primarily due to weak markets. The Davis Strait accounted for 57 percent of the landings with the remainder primarily coming from the Hopedale Channel.

1983

The 1983 TAC for the individual shrimp stocks remained the same as in 1982. Individual quotas continued to be assigned to the domestic operators in the Hopedale Channel. Other areas were fished competitively but the 5,000 tonnes quota in the Davis Strait was split on a 60:40 basis between the domestic and foreign charter operators.

Nine vessels participated in the fishery in the Davis Strait, six of which were domestically owned. Catches in the Davis Strait totalled 4,014 tonnes compared to 2,660 tonnes in the previous year, as lower catch rates were offset by an increased effort.

Five licencees participated in the Labrador fishery, with 97 percent of the catch being made in the Hopedale Channel. Overall landings were 5,044 tonnes an 8 percent increase from the previous year.

1984

In 1984 total landings in the northern shrimp fishery were 3,281 tonnes, the lowest level since the beginning of the fishery in 1978 and a 35 percent decline from the previous year. Approximately 70 percent of the landings were caught in the Davis Strait with the remainder caught in the Hopedale and Cartwright Channels. The primary cause of the decline in landings was a 37 percent reduction in effort; in 1983, nine active licencees fished for 1,074 days whereas in 1984, the eight active licencees fished only 678 days.

1985

Northern shrimp catches for 1985 were 4,762 tonnes, a 45 percent increase from 1984. Sixty percent of the landings were made in the Davis Strait with the remaining catch coming almost exclusively from the Hopedale Channel. Nine licencees were active, one more than the previous year. One domestic vessel, the M.V. Pandalus sank in June, and was replaced by a foreign chartered vessel.

3. DESCRIPTION OF INDIVIDUAL LICENCEES

The northern shrimp fishery is conducted by a small number of highly diverse participants. The operations of the individual licencees are characterized by a wide range of catch rates, effort levels and cost structures and much of the information remains the proprietary information of the individual companies. Nevertheless, this section will provide a broad overview of the individual companies using information that is currently in the public domain.

Table 2 overviews the current position of the 12 northern shrimp licences that were issued in the late 1970's. Fishery Products International continues to hold two northern shrimp licences but has not been active in the fishery since 1982. All other licencees are active in the fishery, although the licence issued to Makivik was inactive in the fishery between 1982 and 1985, inclusive.

Generally, participants in the northern shrimp fishery operate their own vessel crewed by Canadians. The two Labrador based licencees, the Labrador Fishermen's Union Shrimp Co. Ltd., and the Torngat Fish Producer's Co-op Ltd. utilize their licences by chartering foreign vessels. The chartered vessels are generally based in the Faroese Island or Greenland and are licenced to fish in Subarea 1. The chartered vessels pay a royalty to the Canadian licence holder for the privilege to fish in Subarea 0, and the licence holder takes a share of the landed value without having to make a financial commitment to the industry. Prior to 1986, the chartered vessel also did not have

to label its output **Product of Canada** and whereas it bore the expense of paying the Canadian licence holder a royalty, it was not subject to the tariff on shrimp sold in the European Economic Community (EEC). Operators of domestic vessels were subject to a 12 percent tariff on their shell-on shrimp sales to the EEC.

Table 3 indicates that the charter vessels have a more consistent effort, as well as a higher catch per day fished and catch per vessel than the average domestic operator. The charter operators' higher productivity occurs despite being restricted to fishing the Davis Strait since 1982, and thereby not having a flexibility to fish for shrimp on the Labrador coast.

Table 4 completes the review of the individual northern shrimp licencees by indicating the wide diversity in their relative access to groundfish. Northern shrimp provides a fishery for the latter half of the year and access to groundfish has traditionally been considered essential to the viability of a northern shrimp operation. The individual operators of domestic vessels have other access to groundfish should they undertake landings under the Resource Short Plant Program.

TABLE 2
DESCRIPTION OF NORTHERN SHRIMP LICENCEES

ORIGINAL LICENCE HOLDER	HOLDER IN 1985	NUMBER OF LICENCES	NUMBER OF ACTIVE LICENCES 1985	YEAR OF ISSUE	VESSEL OWNED 1985	GROUNDFISH LICENCES	GROUNDFISH E.A.
A. Fishery Products	Fishery Products Int.	2	0	1978	YES	YES	Excellent
B. Newfoundland Fisheries Union Producers Co-op Society	Labrador Fishermen's Union Shrimp Co. Ltd.	2	2	1979	NO	NO	None
C. Labrador Fishermen's Emergency Policy	Torngat Fish Producer's Co-op	1	1	1979	NO	NO	None
D. United Maritime Fishermen	Mersey Seafoods	1	1	1978	B.C.M. Atlantic	1	Very Good
E. Bickerton Industries	Mersey Seafoods	1	1	1978	Mersey Viking	1	Very Good
F. Eastern Quebec Seafoods (Les Fruits De la mer de l'est)	Same	1	1	1978	No	1	Some /RSPP
G. Quebec United Fishermen (Pêcheries Unis du Quebec)	Pêches Nordic	1	1	1978	Kristina Logas and Lumaaq	1	Some/RSPP
H. Makivik	Inactive	1	0	1979	NO	NO	None
I. Carapec Ltd.	Caramer	1	1	1978	Carapec # 1	1	Minimal/RSPP
J. Lameque Co-op Ltd.	032643 N.B. Ltd.	1	1	1978	NO	1	Some/RSPP

* RRSP/Resource Short Plant Program

TABLE 3

DOMESTIC AND FOREIGN SHRIMP CHARTERS' LANDINGS AND EFFORT IN DAVIS STRAIT AND HOPEDALE CHANNEL

	1981	1982	1983	1984	1985
DAYS FISHED					
DOMESTIC	1048	424	702	328	553
CHARTER	412	227	364	298	391
TOTAL	1460	651	1066	626	944
CATCH (t)					
DOMESTIC	4727	2708	2966	1344	2481
CHARTER	3240	1780	2045	1647	2279
TOTAL	7967	4489	5011	2991	4760
CATCH PER DAY FISHED (t)					
DOMESTIC	4.5	6.4	4.2	4.1	4.5
CHARTER	7.8	7.8	5.6	5.5	5.8
OVERALL AVERAGE	5.4	6.9	4.7	4.8	5.0
NUMBER OF VESSELS FISHING*					
DOMESTIC	8	7	6	5	6
CHARTER	3	3	3	3	3
OVERALL AVERAGE	11	10	9	8	9
CATCH PER VESSEL[1] (t)					
DOMESTIC	591	386	494	269	413
CHARTER	1080	594	681	549	760
OVERALL	724	449	557	374	529

* Assumes each licence is represented by at most one vessel.

TABLE 4
1986 GROUNDFISH ENTERPRISE ALLOCATIONS OF NORTHERN SHRIMP LICENCEES

	COD			AMERICAN				
	2J3KL	OTHER	REDFISH	PLAICE	YELLOWTAIL	TURBOT	OTHER	TOTAL
FPI	63,115	21,477	27,223	52,973	13,172	17,117	10,183	205,260
Labrador Fishermen Union Shrimp Company	-	-	-	-	-	-	-	-
Torngat	-	-	-	-	-	-	-	-
Mersey Seafoods	6,212	325	1,550	56	25	639	164	8,971
Les Fruits de le mer de l'est	738	100	250	-	-	220	-	1,308
Peches Nordic	738	100	250	-	-	220	-	1,308
Caramer*	-	2,358	4,746	-	-	-	1,938	9,038
Makivik	-	-	-	-	-	-	-	-
032683 N.B. Ltd.	1,710	200	630	56	25	389	-	3,010

* The figures for Caramer represent the enterprise allocation held by the Province of New Brunswick that is fished by Caramer using vessels leased from the Province of New Brunswick. Caramer does not possess a groundfish enterprise allocation but like the other members of the Independent Operators Group, is eligible to fish stocks that are fished competitively.

4. ECONOMIC ASSESSMENT

4.1 INTRODUCTION

An economic assessment of the northern shrimp fishery is hampered by a number of significant problems:

a) There are a small number of participants each of which has unique capital costs, management, catch rates and access to groundfish. Many of these operations have not maintained a consistent presence in the fishery. As a consequence, the concept of an "average" enterprise has a limited applicability in the northern shrimp fishery.

b) There has not been a systematic collection of costs and earnings data since 1980. An attempt was made to conduct a survey in 1984, but the survey encountered difficulties in gathering a consistent set of data given the presence of only a few operators and some instances of a lack of co-operation by industry. In the spring of 1985 the Northern Shrimp Advisory Committee determined that a collection of costs and earnings data was not appropriate at that time.

c) The licencees are spread among the four DFO Atlantic regions and four Provinces, which complicates data collection.

A number of factors currently favour the economics of northern shrimp operations:

a) groundfish market prices - the current buoyant groundfish markets provides a cushion for northern shrimp operators with significant access to groundfish.

b) Canadianization of the RSPP - Canadianizing the RSPP provides northern shrimp licencees with more potential to augment their groundfish landings. This is particularly noteworthy for northern shrimp licencees with a limited access to groundfish.

c) lower fuel prices - a 1¢ per litre reduction in the price of diesel fuel reduces daily fuel costs by $50-70 per sea day.

d) currency depreciations - the recent depreciation of the Canadian currency against foreign currencies has increased the profitability of shrimp sales into these markets. For example, in recent years the Canadian dollar has fallen significantly against the U.S. dollar; in the last year the Canadian dollar has also depreciated 25 percent against the Japanese yen, 26 percent against the German mark, 22 percent against the French franc and 9 percent against the U.K. pound.

e) lower interest rates - lower interest rates reduce the cost of short term borrowing for working capital and reduces the cost of financing additional long-term investments. Depending on the nature of their debt, a firm may also choose to re-finance existing assets at a lower debt cost.

f) stronger shrimp markets - shrimp markets are currently quite strong. The price of whole, cooked 90-120 count/kg. CIF Europe shrimp increased from $3.20/kg in April, 1985 to $4.06/kg in April, 1986 and to $5.00/kg in October, 1986.

This section assesses the financial position of two hypothetical northern shrimp vessels. Hypothetical operations are used as an analytical device due to a lack of costs and earnings data on the individual operations and the lack of applicability of the concept of an average vessel. The profitability of the hypothetical vessels are calculated on the assumption that each vessel catches northern shrimp and cod in the specified volumes and catch rates and incurs costs of the specified magnitude. The relative importance of various factors in the fishery are measured and amendments can be made as better data becomes available. The following is therefore not a definitive statement on the economics of the northern shrimp fishery but a preliminary assessment subject to the availability of better costs and earnings data.

The analysis utilizes a computer model that was developed to consider the economic implications of a vessel engaging in a number of discrete fisheries over a multi-year period. The contribution of each fishery to the overall fixed costs of the vessel is calculated, as well as an overall economic assessment of the fishing enterprise. Prices, catch rates, and effort levels are projected for a 15 year period on the assumption that conditions in the base period will prevail throughout what may be regarded as the foreseeable future.

The northern cod fishery is an important complement to the seasonal northern shrimp fishery. The analysis will thereby include an assessment of the contribution to enterprise viability that comes from harvesting and processing northern cod.

4.2 VESSEL SPECIFICATIONS

Table 5 profiles the hypothetical vessels that will be utilized in the analysis. The assumption is that two freezer trawlers 5 years old have been purchased in 1986 to enter the northern shrimp fishery. Both vessels have a crew of 24 (aside from the skipper), 16 of whom are on board in each trip. The crew is thereby assumed to work 2/3 of the vessel trips. The skipper, however, is on board the vessel at all times.

A key figure among the vessel specifications is its purchase price. There is a high margin of uncertainty regarding the accuracy of the purchase cost estimate given the lack of information on transactions involving freezer trawlers. However, National Sea Products recently purchased a 91 metre, 10 year old factory freezer trawler, the Scombrus, at a cost of $7.4 million. A new 81 metre factory freezer trawler is estimated to cost $25 million whereas a new wetfish trawler has been priced at $12 million.

TABLE 5
PROFILE OF VESSEL SPECIFICATIONS

VESSEL SPECIFICATIONS	42 m. Trawler	58 m. Trawler
LOA (m)	42	58
BHP	1600	2100
CARGO CAPACITY (t)	200	400
MAXIMUM TRIP LENGTH (DAYS)	40	90
PURCHASE COST ($MILLION)	4	6
YEAR OF PURCHASE	1986	1986
AGE WHEN PURCHASED (YEARS)	5	5
CREW SIZE	16	16
PROCESSING CAPACITY	YES	YES
FREEZING CAPACITY	YES	YES

In this analysis the 42 m. and the 58 m. trawlers are estimated to cost $4 million and $6 million, respectively. Since the vessels are 5 years old they are assumed to have 20 years remaining of their working life.

4.3 FISHING PLANS

The fishing plan of a particular vessel is dependent on the round trip steaming time to the grounds, the length of the fishing season, the enterprise allocation (if applicable), the vessel's cargo capacity, catch rates and fuel storage capacity. Larger freezer trawlers have a large product and fuel storage capacity, tend to take fewer trips of longer duration per year and spend less time steaming to and from the grounds.

Both vessels are assumed to spend the initial portion of the year, January to mid May, fishing northern cod. The vessels are then refitted and in June commence the northern shrimp fishery. Both vessels are based in the Maritimes. Trip lengths are based on vessel specifications and the recorded trip lengths for vessels of a similar dimension. Table 6, below, summarizes the fishing plans of both vessels.

TABLE 6
HYPOTHETICAL FISHING PLANS

	FISHING PLAN				TRIP LENGTH		
	FISHING DAYS	STEAMING DAYS	DAYS AT SEA	NUMBER OF TRIPS	FISHING DAYS	STEAMING DAYS	DAYS AT SEA
42M TRAWLER							
Shrimp Trips	90	30	120	3	30	10	40
Cod Trips	72	48	120	8	9	6	15
Total	162	78	240	11	NA	NA	NA
58M TRAWLER							
Shrimp Trips	90	20	110	2	45	10	55
Cod Trips	90	30	120	5	18	6	24
Total	180	50	230	7	NA	NA	NA

NA - Not Applicable

4.4 VESSEL REVENUE

The revenue to a freezer-trawler from the sale of shrimp is based on the catch per unit of effort (CPUE), the number of days fished, the size composition of the catch, the product composition and the price for the various products in the various markets. The following section considers the impact of these factors.

a) Catch Rates

A previous section has indicated that the three principal areas in the northern shrimp fishery are the Davis Strait, the Hopedale Channel and the Cartwright Channel. Appendix A, in reviewing catch rates in the prime areas, indicates that the catch rates in Davis Strait have been relatively stable since 1982. In the Hopedale Channel, catch rates have been somewhat variable in the 1980's, but catch rates are generally lower than the mid 1970's. In the Cartwright Channel, catch rates have declined since the mid 1970's and have been even more variable than the Hopedale Channel.

The catch rate of a freezer trawler is based on the vessel's size, horsepower, processing capacity, gear, electronics, experience of the crew, environmental conditions, and the availability of fish. The percentage of a vessel's shrimp catch that is retained, rather than being discarded, is also positively related to the market price for small shrimp.

In the following economic assessment, the 42 m. trawler is assumed generally to catch 5.0 tonnes per day when fishing shrimp, a catch rate that is comparable to the average rate of domestic operators. The vessel is assumed to fish northern cod at a rate of 30 tonnes per day (round weight).

In recognition of its larger size, the 58 m. trawler is assumed to catch shrimp and cod at a rate of 6 and 36 tonnes per day (round weight), a 20 percent increase on the other vessel's catch rates.

b) Size Composition of the Catch

From an economic perspective, it is not only the physical level of the CPUE that is important, but also, among other things, the value of the CPUE. A significant determinant of the unit value of shrimp is the size composition of the catch since price is positively related to product size. There has not been a consistent trend in the size of the northern shrimp catch as size composition in any year depends on the strength of a particular year class. In 1984 and 1985, for instance, there was a notable presence of small shrimp.

In order to obtain some measure of the size composition of the shrimp catch, a random sample was taken, by the author, of the shrimp sizes from 1985 weekly vessel catches by five charter vessels operating in the Davis Strait. The following results were obtained.

TABLE 7
SHRIMP SIZE FROM A RANDOM SAMPLE OF CATCHES

SHRIMP SIZE (PER KG.)	CATCH (KG.)	%
LT 90	70,427	11.4
90 - 120	240,643	39.4
120 +*	275,249	45.1
Discards	25,059	4.1
Total	611,378	100.0

* This category (120 +) includes an insignificant amount of shrimp labelled mixed or small.

Although these results are a small sample from a single area in a single year, this is the only data available on size composition of the catch that is recorded in a manner that can be related to product value[1]. Therefore, the percentage size composition breakdown in Table 7 will be used in the following assessment.

c) Product Composition

The product composition and market destination depends upon the size composition of the catch (e.g. larger raw shrimp are required for the Japanese market), the prevailing market prices, the producer's tariff status (to date, the foreign charter operators have had a preferred tariff position in the European market), currency fluctuations, and the availability of suitable equipment to engage in on-board secondary processing such as peeled shrimp.

The 1984 report from the DFO Observer Program on the northern shrimp fishery found that the charter vessels produced 65 percent of their shrimp catch into frozen cooked shrimp, 15 percent frozen raw and the remaining 20 percent was comprised of such products as peeled frozen shrimp, meal, and tails cooked in shell frozen. In 1985, the charter vessels produced 85 percent of the catch as frozen raw with the remaining 15 percent frozen cooked. The vessel logs for two domestic vessels in 1985 indicate that 20 percent was frozen raw and 80 percent frozen cooked. Some of the vessels' frozen raw production is subsequently peeled on shore.

1 The CAFSAC data on size frequency cannot be readily interpreted in terms of sizes that can be used as the basis for a projection of vessel revenue.

The following assessment assumes that in each year, 100 percent of the vessel's shrimp catch is processed into frozen cooked shrimp for the European Economic Community. The assumption on product composition is somewhat over-simplified as the shrimp producers are likely to maintain a presence in the American and Japanese markets so as to maximize the gains (minimize the losses) associated with swings in individual markets or currency fluctuations.

d) Catch Prices

Table 8 illustrates the calculation of the weighted average price that is to be associated with round weight shrimp landings of a particular size. The unit value of shrimp (round weight) is calculated by deducting from the market value (product weight) the loss in weight by cooking[2] and also the cost of selling the product. Selling expenses include the packaging charge (assumed to be 4 percent) and the cost of marketing the product either directly or through brokers and agents (5 percent)[3]. The sales value has been further reduced by 12 percent on the assumption that the vessel operator bears the entire cost of the tariff on whole shrimp entering the European Economic Community. A market price of $4.53/kg. is applied for the whole cooked, 90-120 count/kg. shrimp, a price that is below the current market price, but which will be assumed to

2 Based on STACAC standard conversion factors.

3 The market prices to be used are CIF Europe, but for analytical convenience, the freight and cold storage charges associated with marketing the product have been included as an operating cost.

prevail through the projection period. The price of shrimp that is either larger (70-90 count/kg) or smaller (120+ count/kg.) is based on an interpretation of the percentage differentials that exist in recent contracts for royalty charters for the northern shrimp fishery. The weighted average price of shrimp per kg. ($2.71) that is calculated in Table 8 is independent of the catch rate given that the size composition of the catch is not affected by the catch rate. Assuming a different size composition, product composition or market destination would dramatically influence the unit value of the shrimp landings and thereby the overall economic viability of an operation.

TABLE 8
DERIVATION OF UNIT VALUE OF SHRIMP IN ROUND WEIGHT (RW)

SIZE COMPOSITION	DAILY CATCH R.W./KG.	UNIT VALUE OF PRODUCT WT. CAN. $/KG.*	LESS 9% LOST YIELD	LESS 9% SELLING EXPENSE	LESS 12% TARIFF	UNIT VALUE R.W./KG.
70 - 90/Kg.	690	6.56	0.59	0.59	0.78	4.60
90 - 120/Kg.	2,364	4.53	0.41	0.41	0.54	3.17
120+/Kg.	2,700	2.94	0.26	0.26	0.35	2.07
Discard	246	-	-	-	-	-
	6,000	3.86				2.71

* CIF Europe

Another necessary assumption in assessing the viability of the harvesting operation is the price to be paid the operator of the freezer trawler for harvesting northern cod. Often the owner of the freezer trawler also owns the groundfish processing plant and the price paid for cod landings is a transfer price within the company. A price of $0.50 per kg. ($0.226 per lb.) round weight was paid under the 1985 Resource Short Plant Program[4], but, since 1985, the market price for cod has increased quite substantially. The assumption is made that in each year of the projection period, a trawler will receive the equivalent price of $0.254 per lb. (round weight), a 12% increase on the 1985 price. (A latter section of this paper will assess the profit (loss) associated with processing groundfish to the final product stage.)

The cod is stored on board the vessel as gutted-head-off frozen (H & G) on the assumption of a yield of 60%.

4.5 VESSEL COSTS

There is a lack of data available on the cost of fishing with a freezer trawler. The following assumptions on the costs are based on the best available data from a range of recent studies on the economics of operating freezer trawlers and from information available with respect to wetfish trawlers.

4 Economic Analysis of the 1984 Resource Short Plant Program, Newfoundland Region, Economics Branch, Newfoundland Region, May, 1986.

a) Provisions: Provisions are costed at $15 per day at sea per crewmember.

b) Freight and Storage Charges: The shrimp prices are CIF Europe and provision must therefore be made for the cost of transporting the shrimp to market. Freight charges for sending refrigerated shrimp from Halifax to Europe are $240 per tonne. It is also assumed that on average, the product will undergo six weeks of storage charges and on average, such charges are estimated at one cent a pound for handling (a one-time charge) and one cent a pound per month for storage. Each metric tonne of product stored for two months would cost $66 per tonne ($22 for handling and $44 for storage). The cost of storing a metric tonne of product for six weeks and then transporting it to Europe would be $306 per tonne (240+66).[5]

c) Salt: The cost of salt has been estimated at $20 per tonne of shrimp.

d) Other Operating Costs: Variable operating costs such as travel, vessel licences, minor purchases and other operating costs are estimated at $300 per day at sea on a shrimp trip, and $250 per day at sea on a cod trip for both vessels.

e) Fuel Costs: The initial assumptions underlying the fuel costs estimates are:[6]

1. that such large medium speed diesel engines consume diesel fuel at the rate of 0.16 kg. per BHP hour;

2. that such vessels spend 60 percent of their time on the fishing grounds towing gear, and the remainder of the time on standby or hauling gear. The percentage of a fishing day spent fishing or on standby was based on analysis of statistics on the hours fished per trip in the vessel logs. Days spent on standby is also presumably related to both the vessel size and environmental conditions, but such factors were not built into the analysis;

3. that 90 percent of full power is used when towing gear, 20 percent of full power is used on standby, and 75 percent of full power is used steaming;

4. that the price of diesel fuel is $447.85 per tonne.[7]

The fuel consumption per trip and per day fishing or steaming for both vessels is derived in Table 9.

f) Labour Costs: Labour contracts vary between the various operators but it is reasonable to assume a 34% share of the catch being dedicated to the crew share. In this analysis, deckhands are assumed to earn 31 percent of the catch while the skipper earns 3 percent. Obviously, labour costs rely on the relative bargaining strengths of vessel owners and labour, respectively, and is one of the few costs that has a measure of flexibility after the vessel has been purchased.

g) Repair and Maintenance Costs: Repair and maintenance costs are (in theory) a function of: fishing effort, the vessel's age, size and complexity, and the previous maintenance schedule. However, in preparing a 15 year projection of vessel repair and maintenance expenditures, it is difficult to quantify the extent repair and maintenance expenses vary over time. Annual repair and maintenance costs for the 42 m. trawler are assumed to be $100,000 for the shrimp and cod fisheries, respectively. The 58 m. trawler is assumed to spend $120,000 on repair and maintenance to engage in the shrimp and cod fisheries, respectively. Such annual costs are typical of the costs often assumed for the repair and maintenance of freezer trawlers. The cost of the CSI refit every four years is included in such estimates and is assumed to be evenly spread throughout the years.

h) Gear: The annual gear expenses are assumed to be $90,000 per fishery for both vessels.

5 As a purely technical point it has been assumed that 9% of the round weight is lost through cooking the shrimp. However, the model assumes the entire round weight landings are stored and shipped and therefore the storage and shipping charge of $306 per tonne has been reduced by 9% to $279 per tonne. The assumption is also made that packaging adds 4% to the storage weight, an amount that compensates for the 4% of round weight lost through discards.

6 The section on fuel costs is based on an interpretation and extrapolation of the treatment of fuel costs in a 1981 NORDCO paper "Evaluation of Options by which the Torngat Fish Producers Cooperative May Exercise its Licence to Fish Offshore Shrimp".

7 The current posted price per litre is 36.84¢ per litre after federal sales and excise taxes have been deducted. The cost of a tonne of diesel fuel is assumed to equal:

= Cost/Litre X Litres/Imp. Gal X Imp. Gal/Barrel X Barrels/Tonne
= .3684 X 4.656 X 35 X 7.46
= $447.85

TABLE 9

FUEL CONSUMPTION PER TRIP PER VESSEL

42 m. Trawler	A SHRIMP TRIP			A COD TRIP		
	Duration (Hrs)	Power (BHP)	BHP (Hrs)	Duration (Hrs)	Power (BHP)	BHP (Hrs)
Port To Grounds	120	1,200	144,000	72	1,200	86,400
Towing Gear	432	1,440	622,080	129.6	1,440	186,624
Standby	288	320	92,160	86.4	320	27,648
Grounds to Port	120	1,200	144,000	72	1,200	86,400
- TOTAL	960		1,002,240	408		387,072
+10% For Auxiliaries*			100,224			38,707
- OVERALL TOTAL			1,102,464			425,779
FUEL CONSUMPTION	t	$		t	$	
- Per trip (t)	176.394	78,998		68.124	30,509	
- Per fishing day	4.190	1,876		4.190	1,876	
- Per steaming day	5.068	2,269		5.068	2,269	

58 m. Trawler	A SHRIMP TRIP			A COD TRIP		
	Duration (Hrs)	Power (BHP)	BHP (Hrs)	Duration (Hrs)	Power (BHP)	BHP (Hrs)
Port To Grounds	120	1,575	189,000	72	1,575	113,400
Towing Gear	648	1,890	1,224,720	259.2	1,890	489,888
Standby	432	420	181,440	172.8	420	72,576
Grounds To Port	120	1,575	189,000	72	1,575	113,400
- TOTAL	1,320		784,160	936		789,264
+10% For Auxiliaries*			178,416			78,926
- OVERALL TOTAL			1,962,576			868,190
FUEL CONSUMPTION	t	$		t	$	
- Per trip (t)	314.0	140,624		138.910	62,210	
- Per fishing day	5.50	2,463		5.50	2,463	
- Per steaming day	6.65	2,978		6.65	2,978	

* assuming a prorata share of the fuel consumed by auxiliaries is consumed on a fishing or steaming day respectively

i) Fixed Costs:

1) Insurance - A range of estimates is available for vessel insurance and this analysis has assumed an insurance cost of 3.0 percent of the depreciated value of the capital stock.

2) Opportunity Cost of Capital - In economic analysis, the invested capital is costed at its value in its best available use. In this analysis, the opportunity cost of capital is assumed to be 12 percent of the depreciated value of the capital stock, 2 percent above the current prime rate in Canada. The opportunity cost of capital should thereby be distinguished from the financing costs associated with the purchase of the vessel. For example, if a vessel has a useful life of 15 years, but the longest available financing term is 10 years, the analysis would indicate an opportunity cost of capital for each of the 15 years. The opportunity cost of capital is therefore independent of the debt/equity ratio or the financing terms for debt repayment. The opportunity cost of capital is included as a cost in calculating profitability regardless of the interest charge being paid in that year. The opportunity cost of capital is excluded in calculating the internal rate of return associated with an investment.

3) Other Costs - Fixed costs such as shore management costs amount to $80,000 per annum for both vessels.

4) Depreciation and Scrap Value - The vessel is depreciated on a straight-line basis over the remaining economic life of the vessel. Cash flows are projected outward for 15 years which is regarded as the foreseeable future of the vessel then sold as scrap at 100% of its depreciated value. The scrap value is a source of revenue to the enterprise in Year 15.

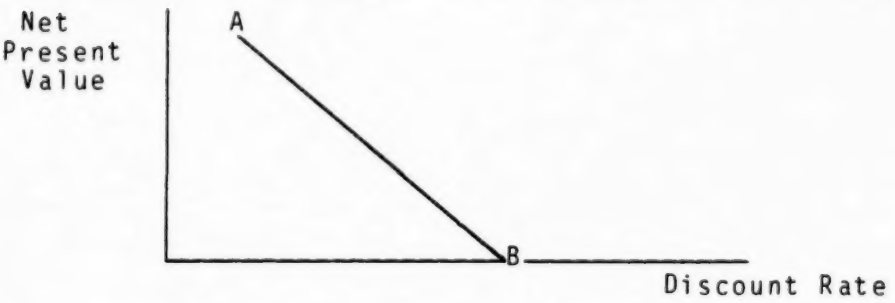
4.6 ECONOMIC VIABILITY OF VESSELS

a) Definition of Viability

This section assesses the viability of both vessels on the basis of the assumptions that have been outlined. A commonly used determinant of viability is the net present value of the 15 year cash flow at various discount rates. In this analysis, cash flow is defined as the economic profit plus the opportunity cost of capital and depreciation. The discount rate assigns a weight to the future values of the 15 year cash flow. The higher the discount rate, the more weight is attached to cash flows in the early years and the less weight is attached to cash flows in the latter years. The internal rate of return is the discount rate at which the net present value of the cash flows equals zero.

Figure 3 illustrates the relationship between the net present value, the discount rate, and the internal rate of return. Line AB represents the net present value of the cash flow at various discount rates, a value that declines as future profits are assigned a lower weight at higher discount rates. The internal rate of return is represented by Point B.

FIGURE 3
NET PRESENT VALUE AND THE DISCOUNT RATE



The choice of a discount rate is critical to an assessment of the present value of the cash flows associated with an investment. Generally, the higher the investor's rate of return on alternative investments and the level of time-related risk in a project, the higher the rate that should be used to discount the related cash flows. Time-related risks such as catch or market failure would tend to augment the discount rate used in an analysis of the economics of a fish harvesting operation. Given the debate over the appropriate discount rate that should be used to discount cash flows, the net present value is generally presented under a range of discount rates. For the sake of simplicity this analysis will assess viability by using only the internal rates of return for the projects.

b) Economic Viability of a 42 m. Trawler

Table 10 outlines the income statement for a 42 m. trawler for a typical year when operating as per the specified fishing plan and revenue and cost assumptions. Shrimp is caught at a rate of 5 tonnes per day for a total catch of 450 t. Cod is caught at a rate of 30 tonnes per day (round weight) for a total catch of 2,160 t.

The enterprise does not achieve an economic profit, defined as a 12 percent return on invested capital. Cod trips make roughly twice as large a contribution to fixed costs as compared to shrimp trips. The internal rate of return for the vessel over its 15 year period of operations is 5 percent.

TABLE 10
ANNUAL INCOME STATEMENT, 42 M. TRAWLER
($,000)

	SHRIMP TRIPS	COD TRIPS	TOTAL
REVENUE	1,219	1,209	2,428
VARIABLE COSTS:			
Repair & Maintenance	100	100	200
Gear	90	90	180
Fuel	236	243	480
Freight, Shipping, Storage	125	-	125
Salt	9	-	9
Provisions	30	30	60
Other Operating	36	30	66
Labour	414	411	825
TOTAL VARIABLE COSTS	1,042	905	1,948
CONTRIBUTION TO FIXED COSTS	176	303	480
FIXED COSTS:			
Insurance	-	-	114
Opportunity Cost of Capital*	-	-	456
Other	-	-	80
Depreciation	-	-	200
TOTAL FIXED COSTS	-	-	850
ECONOMIC PROFIT	-	-	(369)

* Based on a 12 percent Opportunity Cost of Capital.

Table 11 presents the labour incomes that are implicit in the analysis. The labour incomes that result under the sharing arrangements appear to be a reasonable estimate of crew costs.

TABLE 11
ANNUAL LABOUR INCOMES, 42 M. TRAWLER

	INCOMES PER MAN
Deckhand's Income	$ 31,373
Deckhand's Income Per Day at Sea	198
Skipper's Income	72,866
Skipper's Income Per Day at Sea	303

c) Economic Viability of a 58 m. Trawler

Table 12 presents the income statement for a 58 m. trawler in a typical year when operating as per the specified fishing plan, revenue and cost assumptions. Shrimp is caught at a rate of 6 tonnes per day for a total catch of 540 t. Cod is caught at a rate of 36 tonnes per day (round weight) for a total catch of 3,240 t.

The vessel does not achieve an economic profit, defined as a 12 percent return on invested capital. The cod trips make more than twice as large a contribution to fixed costs as shrimp. The internal rate of return for the vessel over its 15 year period of operation is 10 percent.

TABLE 12
ANNUAL INCOME STATEMENT, 58 M. TRAWLER
($,000)

	SHRIMP TRIPS	COD TRIPS	TOTAL
REVENUE	1,463	1,814	3,277
VARIABLE COSTS:			
Repair & Maintenance	120	120	240
Gear	90	90	180
Fuel	281	311	592
Freight, Shipping, Storage	150	-	150
Salt	11	-	11
Provisions	28	30	58
Other Operating	33	30	63
Labour	497	616	1,114
TOTAL VARIABLE COSTS	1,211	1,198	2,409
CONTRIBUTION TO FIXED COSTS	251	616	867
FIXED COSTS:			
Insurance	-	-	171
Opportunity Cost of Capital*	-	-	684
Other	-	-	80
Depreciation	-	-	300
TOTAL FIXED COSTS	-	-	1,235
ECONOMIC PROFIT	-	-	(367)

* Based on a 12 percent Opportunity Cost of Capital.

Table 13 indicates that the labour income that results from the sharing arrangements appear to be a reasonable estimate of crew costs.

TABLE 13
ANNUAL LABOUR INCOMES, 58 M. TRAWLER

	Incomes Per Man
Deckhand's Income	$ 42,335
Deckhand's Income Per Day at Sea	276
Skipper's Income	98,326
Skipper's Income Per Day at Sea	418

4.7 COD PROCESSING REVENUE

A northern shrimp licencee who landed cod at its own processing plant would include the profit (loss) from processing cod in an assessment of its participation in the northern shrimp/cod fishery. This section assesses the revenue a plant derives from processing the cod landed by both vessels.

a) Cod Landings: as per the cod catch options for each vessel.

b) Product Composition: the cod is landed as gutted-head-off frozen (H & G) on the assumption that H & G fish comprise 60 percent of the round weight. The yield of the individual products in relation to the round and H & G weight is provided in Table 14. The fillet/block ratio is 3 to 1, which is below the rate attained from frozen H & G fish in the 1984 RSPP, Newfoundland Region. The relatively low recovery rate from the by-product, minced block, is caused by much of the nape having been lost when the head was removed at sea.

TABLE 14
PRODUCT YIELD (%) OF ROUND AND LANDED WEIGHT

	ROUND WEIGHT	H & G WEIGHT
Fillets	23.25	38.60%
Block	7.75	12.87%
Minced Block	2.0	3.32%
	33.0	54.79%

c) Product Prices: The recent surge in the U.S. groundfish market prices has highlighted the dependency of an economic assessment on the product prices. In April, 1985, cod block and cod fillet were priced (in US $) at $2.31/kg. and $2.76/kg. whereas seventeen months later, the corresponding products were priced at $3.20/kg. and $3.86/kg. The impact of this 38-40 percent increase in prices over seventeen months was amplified by a slight depreciation of the Canadian dollar (from $1.37 to $1.38). Whereas the comparison of April 1985 and September 1986 market prices likely overstates the average annual increase[8], the increase in price has been substantial.

8 As of October 1986, the average Canadian ex-plant price for cod block (cod fillet) is projected to increase from $2.62/kg. to $3.53/kg. between 1985 and 1986, a price increase of 34 percent. Similarly, the price of cod fillets is projected to increase from $3.70/kg. to $4.19/kg., an increase of 13 percent.

The following assessment of the viability of processing cod assumes that over the 15 year projection period, cod block and cod fillet were priced (in US $) at $2.65/kg. and $3.09/kg., respectively. The Canada/US exchange rate is assumed to remain stable. Minced block is assumed to be sold at $1.32/kg. A latter section assesses the sensitivity of the results to a range of shrimp and groundfish price options.

4.8 COD PROCESSING COSTS:

The following costs of processing cod are estimated on the basis of the best available information:

a) Selling Expenses: are comprised of four separate items. Sales commissions comprise 5% of the gross value of sales. Duties are estimated at 1.5% of the gross value of sales. Freight is estimated to cost $0.22/kg. Storage charges are compiled on the assumption that one third of cod production is stored in commercial cold storage at a cost of $0.10/kg.

b) Raw Material Cost: the raw material for fillet and block production is costed at the rate paid the trawlers for their cod landings, $0.56/kg. round weight. The raw material cost is shared between fillets and blocks whereas minced cod, as a by-product, is not charged for raw material.

c) Direct Labour Cost: is the cost of handling, discharging, filleting, skinning, trimming, packaging and freezing fish in a plant. Direct labour is costed at $0.51/kg. for cod block, $0.60/kg. for fillet and $0.24/kg. for minced, rates that resulted from an intensive analysis of the costs of processing wetfish trawler fish. The wage benefits that pertain to direct labour are costed at 19 percent of the direct labour cost.

d) Packaging Cost: the packaging cost for fillets, block and minced cod is $0.11/kg., $0.09/kg. and $0.066/kg. respectively.

e) Variable Overheads: variable overheads include fuel, the clean-up crew, miscellaneous supplies, and other costs. Wage and other variable overheads are estimated as 19 and 13 percent of the direct labour cost, respectively. The wage benefits that pertain to variable overhead wages are costed at 19 percent of such wages.

f) Fixed Overheads: fixed overheads include regular salaries, repairs and maintenance, the fixed portion of utilities, municipal taxes, rentals and leases. Fixed overhead wages and other fixed overheads are costed at 24 and 18 percent of direct labour, respectively.

g) General and Administration: general and administration charges include office operations, communications, professional fees and travel. The Task Force on Atlantic Fisheries set a target of 8 percent of net sales for selling, general and administration expenses. Given that sales commissions have been set at 5 percent of gross sales, general and administration charges are set at 3 percent of net sales.

h) Short-Term Interest: the short term interest cost is calculated on the assumption that 100 percent of the sales cost is carried as a receivable by the company for 60 days at an interest rate of 12 percent.

i) Fixed Costs: There are two fixed costs associated with processing groundfish:

1) Opportunity Cost of Capital: The opportunity cost of capital is defined as 12 percent of the historical cost of an inshore plant capable of processing 2,000-3,000 tonnes of northern cod in the period January to May. A review of the financial statements of various Newfoundland fish processors indicates that the historic cost of such a plant approximates $1.75 million.

2) Depreciation: The building, machinery and equipment, and the related assets of the existing plant are depreciated on a straight-line basis over its remaining 15 year useful life.

There is a cost allocation problem associated with calculating the typical profitability of an integrated operation that harvests and processes both shrimp and groundfish. The problem is to determine the share of such fixed processing costs that relate to processing the groundfish landed by the trawlers.

Two alternate cases will be used to assess the viability of processing the cod landed by the trawlers:

1. Option A: The initial alternative is to assume that the cod supplied by the northern shrimp trawlers is an incidental source of supply to a plant that is primarily supplied by other inshore/offshore vessels. It is therefore unnecessary to assign any of the fixed costs of processing to the integrated northern shrimp/cod fishery.

2. Option B: The second alternative is to assume that the cod landed by the northern shrimp trawlers is processed in a seasonal inshore plant. In such a case, the fixed cost of the groundfish processing plant is assumed to be allocated on a 50/50 basis between the inshore and the trawler groundfish landings.

4.9 VIABILITY OF COD PROCESSING AND OVERALL VIABILITY

Tables 15 and 16 present the income of the operations of a plant processing the cod landed by each vessel. The presence of fixed costs indicate that the income statements pertain to the inshore processing plant (Option B) but the plant contribution is applicable to both Options A and B.

42 M TRAWLER

Cod catches amounted to 2,160 tonnes of cod (round weight) which converts to 1,296 tonnes, H & G. As indicated in Table 15, the processing of the cod generated a gross margin of $690,000 and a plant contribution to fixed costs of $252,000. The gross margin and plant contribution to fixed costs per round kilogram were $0.32 and $0.117, respectively.

In total (combining the results of Tables 10 and 15), harvesting and processing the shrimp catch contributed $176,000 to fixed costs. Cod harvesting and processing contributed $555,000, 55 percent of which was from harvesting cod and the remainder from cod processing.

58 M TRAWLER

Cod catches amounted to 3,240 tonnes of cod (round weight) which converts to 1,944 tonnes, H & G. As indicated in Table 16, the processing of such landings generated a gross margin of $1.036 million and a plant contribution of $379,000. Given the assumptions on

constant variable costs and overhead rates, the gross margin and contribution per round pound were the same as for processing the cod landed by the 42 m trawlers.

In total harvesting and processing the shrimp catches contributed $251,000 to fixed costs whereas harvesting and processing cod contributed $995,000 (60% of which was from harvesting).

TABLE 15
INCOME FROM PROCESSING COD, 42 M. TRAWLER
$,000

	Cod Block	Cod Fillet	Cod Minced	TOTAL
PLANT REVENUE	611	2,139	81	2,831
LESS:				
Sales Commissions	30	107	4	141
Freight	37	110	10	157
Duties	6	17	1	23
Storage	17	50	4	71
NET SALES VALUE	521	1,855	62	2,438
LESS:				
Cost of Landings	302	907	-	1,209
Direct Labour Cost	84	296	10	391
Wage Benefits, Direct Labour	16	56	2	74
Packaging Cost	15	55	3	73
GROSS MARGIN	104	540	47	690
LESS:				
Variable Overhead Wages	17	59	2	78
Variable Overhead Wage Benefits	3	11	1	15
Other Variable Overheads	11	39	1	51
General and Administration	16	56	2	73
Short-Term Interest	12	43	2	56
Fixed Overhead Wages	20	71	2	94
Other Fixed Overheads	15	53	2	70
PLANT CONTRIBUTION	10	208	35	252
LESS:				
Depreciation	-	-	-	58
Opportunity Cost of Capital	-	-	-	105
PLANT PROFIT (LOSS)	-	-	-	90

TABLE 16
INCOME FROM PROCESSING COD, 58M TRAWLER
$,000

	Cod Block	Cod Fillet	Cod Minced	TOTAL
PLANT REVENUE	917	3,208	122	4,247
LESS:				
Sales Commissions	46	160	6	212
Freight	55	166	14	235
Duties	8	25	2	35
Storage	25	75	6	106
NET SALES VALUE	782	2,782	93	3,657
LESS:				
Cost of Landings	454	1,361	-	1,814
Direct Labour Cost	127	445	16	587
Wage Benefits, Direct Labour	24	84	3	111
Packaging Cost	22	83	4	109
GROSS MARGIN	156	809	70	1,036
LESS:				
Variable Overhead Wages	25	89	3	117
Variable Overhead Wage Benefits	5	17	-	22
Other Variable Overheads	16	58	2	76
General and Administration	23	83	3	110
Short-Term Interest	18	64	2	85
Fixed Overhead Wages	30	107	4	141
Other Fixed Overheads	23	80	3	106
PLANT CONTRIBUTION	14	312	53	379
LESS:				
Depreciation	-	-	-	58
Opportunity Cost of Capital	-	-	-	105
PLANT PROFIT (LOSS)	-	-	-	215

Table 17 indicates the internal rate of return associated with harvesting and processing the projected shrimp and cod catches of each vessel over a 15 year period. The term "vessel operation" refers to the activity of harvesting cod as well as harvesting and processing the shrimp on board the vessel. In calculating the internal rate of return, the cash flow from vessel operations has been previously defined. The cash flow from processing cod equals the plant contribution minus that portion of plant capital costs assigned to the integrated harvesting/processing operation. Overall cash flow equals the sum of the cash flow from vessel operations and processing cod.

TABLE 17
INTERNAL RATE OF RETURN (%)

	VESSEL OPERATIONS	COD PROCESSING	OVERALL
42 M. TRAWLER			
Option A	5	NA	15
Option B	5	40	11
58 M. TRAWLER			
Option A	10	NA	20
Option B	10	76	16

NA - Not Applicable.

The relatively low rate of return from vessel operations is offset by a high rate of return from processing cod to generate overall rates of return of between 11 and 20 percent. The integrated harvesting and processing operation associated with the 58 m. trawler is more profitable than that of a 42 m. trawler, due to a better return from vessel operations and greater utilization of processing capacity. Option A is naturally more viable than Option B since under

Option A, the integrated harvesting/processing of shrimp and cod operation is assigned none of the capital costs associated with the $1.75 million historical cost of the cod processing plant.

4.10 SENSITIVITY TO MARKET PRICE VARIATIONS

The foregoing analysis has indicated the relative profitability of harvesting/processing northern shrimp and cod under a specified fishing plan, revenue and cost assumptions. Of course, the conclusions of such analysis are only applicable to the extent the specified assumptions reflect actual conditions that will prevail over the projected period of operation. Variations in vessel size, performance, catch rates, prices, capital or operating costs can significantly alter the conclusions. The following analysis examines the sensitivity of the results to variations in product market prices by comparing the results of the 15 year projection assuming April 1985 prices, average 1986 prices (as estimated in October 1986) and the price assumptions used in the foregoing analysis. Aside from the price changes, all other assumptions on the fishing plan or various costs remain as previously stated.

Table 18 indicates the alternative price scenarios to be used to test for price sensitivity. Shrimp prices are denominated in Canadian dollars and are CIF Europe. The price for the 70-90/kg and the 120+/kg are based on extrapolating the available information on the 90-120/kg. by interpreted percentage differentials in recent royalty charter contracts.[9]

9 To derive the value of shrimp in its round weight, the adjustments for lost yield, selling expense and the EEC tariff as per Table 8 are required.

All the benefits/losses of cod market price fluctuations are deemed to accrue to the processing sector as in all three cases, the price paid the vessel for cod is $0.56/kg. or ($0.254/lb) in round weight or $0.928/kg. ($0.421/lb.), H & G.

TABLE 18
SHRIMP AND COD MARKET PRICES
($CDN/KG)

	APRIL, 1985	AVERAGE 1986	LONG TERM
SHRIMP, CIF EUROPE			
70 - 90/kg.	4.64	7.24	6.56
90 - 120/kg.	3.20	5.00	4.53
120 +/kg.	2.08	3.24	2.94
Discards	-	-	-
WEIGHTED AVERAGE	2.73	4.26	3.86
COD			
Block	3.20	4.25	3.65
Fillet	3.77	4.86	4.25
Minced	1.81	1.82	1.82

Table 19 indicates the variation in the contribution to fixed costs that occurs under three separate price scenarios. For the 42 m. trawler, the contribution to fixed costs increases by 250 to 450 percent if the long term price assumption or 1986 prices are used rather than the April 1985 prices. For the 58 m.trawler, the percentage increases in the contribution to fixed costs that result from using different price projections (rather than April 1985 prices) are somewhat lower but remain substantial.

TABLE 19
CONTRIBUTION TO FIXED COSTS USING DIFFERENT PRICES
$,000

	CONTRIBUTION TO FIXED COSTS			DIFFERENCE FROM CONTRIBUTION USING APRIL 85 PRICES	
	April '85 Prices	1986 Prices*	Long Term PriceP	1986 Prices	Long Term PriceP
42 M. Trawler					
- Harvesting/Processing Shrimp	(60)	258	176	318	236
- Harvesting Cod	303	303	303	-	-
- Processing Cod	(37)	570	252	607	289
TOTAL	206	1,131	731	925	525
58 M. Trawler					
- Harvesting/Processing Shrimp	(32)	350	252	382	284
- Harvesting Cod	616	616	616	-	-
- Processing Cod	(55)	856	379	911	434
TOTAL	529	1,822	1,247	1,293	718

P - projected.
* - estimated as of October 1986

Using the April 1985 prices, neither enterprise was able to generate a positive contribution from harvesting/processing shrimp; however, both vessels had a positive contribution from cod harvesting. The loss on cod processing reflects a negative plant contribution on block and fillet production. The high fillet/block ratio (3/1) substantially mitigated the overall plant losses and only minced production made a positive contribution to processing fixed costs. Under the 1986 price or the long-term price assumption, both the shrimp and cod components of the operation made positive contributions to fixed costs.

Table 20 indicates the internal rates of return that relate to the market price scenarios in Table 18. Whereas the integrated shrimp/cod operation achieves a below marginal rate of return using April 1985 prices, the other price scenarios generate good (the projected long-term price) to excellent (1986 prices) returns.

TABLE 20
INTERNAL RATES OF RETURN USING DIFFERENCE PRICES*

	APRIL 1985 PRICES	1986 PRICES	LONG TERM PRICE ASSUMPTION
42 m. Trawler	(8)	24	11
58 m. Trawler	0	30	16

* Assuming Option B for plant capital costs (i.e. 50 percent of such costs are allocated to the integrated northern shrimp/cod harvesting and processing enterprise).

5. CONCLUSIONS AND RELEVANCE TO CURRENT ISSUES

This section relates the foregoing analysis to current issues in the northern shrimp fishery. The section is organized around the four issues in the fishery that were highlighted in a 1986 Fisheries and Oceans discussion paper "A Long Term Management Strategy for the Northern Shrimp Fishery".[10]

a) Economics of Harvesting

The preceding economic analysis was undertaken to establish a framework for the analysis of the northern shrimp fishery and to outline the existing conditions in that industry. The analysis is hypothetical in nature and examined the economic viability of introducing two trawlers into a northern shrimp/cod fishery and then having the cod processed in a fish plant. This approach was adopted because of the small number of highly diverse participants in the industry and the absence of an adequate information base with respect to the costs and earnings of participants since 1980.

Given the recent volatility of product market prices for shrimp and cod, a number of price scenarios were used to assess the viability of the integrated northern shrimp/northern cod harvesting and processing enterprise.

Using the market prices that prevailed in April 1985, as well as the specified fishing plan, revenue and cost assumptions, the harvesting and processing of shrimp was unable to positively contribute to fixed costs. The contribution from cod harvesting and processing, while positive, was insufficient for either enterprise to generate an overall positive rate of return.

10 This discussion Paper was presented at the Northern Shrimp Advisory Committee meeting in May, 1986 in Montreal.

An excellent rate of return was generated by the overall shrimp/cod harvesting and processing enterprise when 1986 product market prices were applied to the specified fishing plan, revenue and cost assumptions. Shrimp harvesting/processing made 25-30 percent of the overall contribution to enterprise fixed costs and cod harvesting/processing the remainder.

The projected long term price, which was mid-way between April 1985 and average 1986 product market prices, generated a fair overall rate of return for the two enterprises (11-16 percent). Once again, shrimp harvesting/processing generated only 25-30 percent of the contribution to overall enterprise viability and cod harvesting/processing, the remainder.

The analysis indicates that for an operator in the seasonal northern shrimp fishery to be economically viable, without access to an alternative fishery such as northern cod, it would require a dramatically better overall performance than that demonstrated by the hypothetical vessels assessed in this study. The fish harvesting and processing enterprises that were analysed derived the majority of their income from cod rather than shrimp. The profitability associated with the cod fishery is divided between harvesting and processing, a distinction that is irrelevant to the vertically integrated operation.

The foregoing analysis has established a framework to analyse a fishing enterprise that harvested and processed northern shrimp and cod. Given the hypothetical nature of the analysis and the diversity among existing operators in their costs, catch/effort performance and access to groundfish, these results should not be interpreted as a definitive statement on the economics of the overall fishery or of individual operators. Nevertheless, the model which underlies

the analysis constitutes a framework to assess a wide range of circumstances as better data becomes available.

b) Underutilization of Stocks

In the northern shrimp fishery, the TAC is set on a biological basis and, since the TAC is not caught, the stocks are said to be underutilized. Nevertheless it is unclear as to how much of the shrimp resource can be harvested on an economic basis, particularly in non-prime areas.

In 1985, 4,160 tonnes (53%) of the total shrimp TAC of 8,920 tonnes in Subarea 0 and the Hopedale Channel was left in the water. To put this in perspective, if a vessel fished shrimp for 100 days at a catch rate of 6 tonnes/day (a catch/effort performance that few domestic shrimp vessels achieve), its total landings for the year would equal 600 tonnes. Such landings would enable operators to make a positive contribution to the fixed costs although the hypothetical vessels analysed in Section 4 would not achieve more than a marginal rate of return fishing shrimp under such conditions. The 1986 TAC's in Subarea 0 and the Hopedale Channel could accommodate 16 such vessels. The addition of the 1,000 tonne TAC for the Cartwright Channel implies that the three shrimp stocks identified could, in total support 17 such vessels landing an average of 600 tonnes each. In 1986, 12 vessels were licenced to fish northern shrimp, a figure which includes a licence which was banked prior to 1986.

However, a significant constraint on the number of additional northern shrimp licences that can be issued is that many vessels in the existing fleet are either unutilized, underutilized, or in the case of the foreign charter operators, are constrained by vessel quotas. A better price/cost/catch rate environment for shrimp would spur considerably more effort and landings from the existing fleet and reduce the availability of shrimp to new licencees.

Although the biological resource appears adequate to support some additional effort, the impact of additional effort on catch rates remains a concern. The extent that additional effort would lower catch rates is a biological question and the non-existence of an "average" vessel makes it impossible to identify a unique catch rate required for an enterprise to be viable. Nevertheless, the foregoing analysis has indicated that fishing for 90 days at a catch rate of 6 tonnes per day (with the specified price, size, product composition, and market destination), the shrimp fishery makes a much smaller contribution to fixed costs than the cod fishery.

In summary, the TAC in the northern shrimp fishery is set on biological criteria and, in the prime fishing areas, is not being taken. Although there is some room for the issue of additional licences, the number of additional fishing licences that can be issued is constrained by (1) the <u>apparent</u> marginal nature of portions of the existing industry; (2) the threat that additional effort would reduce catch rates; and (3) the underutilized capacity in the existing fleet.

An enterprise allocation agreement that incorporated transferability would assist industry to adjust to any situation in which the issue of additional licences caused excessive effort to be directed at the resource.

c. Underutilized Licences

One reason for the underutilization of stocks is the low levels of effort by certain shrimp licencees and the non-existent effort by others. A consistent failure to utilize a licence should result in the licence being revoked and reassigned to an entity who is willing or better able to make use of the publicly owned shrimp resources.

d. Foreign Royalty Charters

It is not economic for the Labrador-based northern shrimp licencees to operate a northern shrimp vessel without access to a winter fishery unless it achieved a dramatically better overall performance that that demonstrated by the hypothetical vessels assessed in this study. The options for a winter fishery as a complement to a domestic northern shrimp operation are:

1) Groundfish: It would take a real commitment to free up the substantial supply of groundfish to satisfy the demand for a winter fishery by Labrador-based northern shrimp licencees. Underutilized species appear to offer only limited potential for an economic fishery. To access a winter groundfishery as a complement to northern shrimp, the Labrador-based shrimp licencees would have to cooperate with an existing domestic holder of a significant enterprise allocation for groundfish or with the consortium formed to land RSPP fish.

2) Shrimp in Subarea 1: Reciprocal access for Canadian and Greenland vessels in the Davis Strait remains a long-term possibility. In the interim, the Labrador Fishermen's Shrimp Co. has proposed a joint venture whereby a vessel would access the shrimp stocks in both Areas 0 and 1. At this point in time, the joint venture proposal remains somewhat nebulously defined.

APPENDIX A

APPENDIX A - ANALYSIS OF CATCH RATES

The following tables use catch (kg) per hour data from vessel log books to indicate catch rate trends in the Hopedale Channel, Davis Strait and Cartwright channel. The catch from DFO landings data indicate the extent of the coverage of the vessel log data.

TABLE 21
NORTHERN SHRIMP RESOURCE BASE DATA

	1977	1978	1979	1980	1981	1982	1983	1984	1985
HOPEDALE CHANNEL									
Catch, vessel logs (t)	1271	1340	2056	2508	2847	1586	87	616	1382
Catch, DFO Statistics (t)	1203	2109	2693	3938	3382	1707	1014	712	1409
CPUE[1], vessel logs (kg)	573	569	507	449	409	420	341	318	271
NAFO DIVISION 0A									
Catch, vessel logs (t)	-	-	53	360	4406	2531	2097	1568	2537
Catch, DFO Statistics (t)	-	-	254	2254	4474	2660	4014	2279	3073
CPUE[1], vessel logs (kg)	-	-	294	340	305	363	310	307	347
CARTWRIGHT CHANNEL									
Catch, vessel logs (t)	1158	1238	649	117	12	143	2	258	-
Catch, DFO Statistics (t)	1414	1521	1034	170	67	167	3	290	2
CPUE[1], vessel logs (kg)	614	500	299	294	203	381	105	307	-

[1]Catch (kg) per hour fished.

The CPUE, as an index of stock abundance in the Hopedale Channel has declined due to low effort in recent years, the high discard rate in 1985, and changes in seasonal fishing patterns between years. In 1985, the water temperatures in the Hopedale Channel were the lowest for any year for which data is available and the continuation of such temperatures will reduce growth and re-productive potential. New bathymetric charts show a considerable increase in the size of the area which has historically contained shrimp and the prior estimation of biomass have all been revised upward to the level shown below.

	1979	1980	1981	1982	1983	1984	1985
BIOMASS (t):	17800	14700	4900	11600	8200	8500	12800

The high estimate for the biomass in 1985 has led to a 600 tonnes or 8.5% increase in the TAC for 1986 based on a 35 percent exploitation rate of the 1983-85 average biomass. A high discard rate is also likely in 1986, as small shrimp are likely to continue to predominate. In summary, the catch per unit effort in the fishery has declined since the initial years of the fishery in the late 1970's, but there has not been a reliable consistent trend in the 1980's.

In the Davis Strait, the CPUE indices show an upward trend for 1977 to 1982 and stability thereafter. Recent CPUE indices may be biased upward due to improved trawl design and favourable ice conditions in the spring during 1982-84, inclusive. Given the potential upward bias in the CPUE for the Davis Strait, it is possible that the CPUE may be stable rather than growing since 1979.

In the Cartwright Channel, catches ranged from 1,000-1,500 tonnes in the early years of the fishery, but since 1979 have been 300 tonnes or less. The biomass in 1984 and 1985 appears to have increased over previous years, but there is a concern that the prevailing cold water temperature will depress growth and reproduction.

The essential point is that the catch rates in Davis Strait have been relatively stable over the period and have been more variable in the Hopedale and to an even greater extent the Cartwright Channels. The northern shrimp fleet vary the area in which they fished in order to maintain their effective catch rate.

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